

NASA CR-

141660

## TECHNICAL NOTE

## THERMAL AND RADIATION DAMAGE TO SL/1 EREP FILMS

Prepared Under

Contract NAS 9-11500

Task Order HT-65

(NASA-CR-141660) THERMAL AND RADIATION  
DAMAGE TO SL/1 EREP FILMS (Technicolor  
Graphic Services, Inc.) 16 p HC \$3.25

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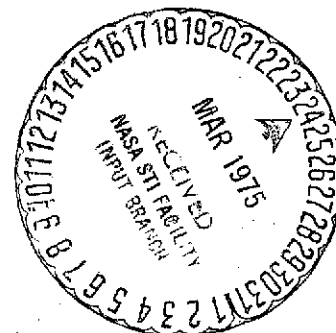
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PREPARED BY

Lincoln Perry

September 1973



NATIONAL AERONAUTICAL AND SPACE ADMINISTRATION  
PHOTOGRAPHIC TECHNOLOGY DIVISION  
LYNDON B. JOHNSON SPACE CENTER  
HOUSTON, TEXAS




Technicolor Graphic Services, Inc.


THERMAL AND RADIATION DAMAGE TO SL/1 EREP FILMS

This report has been reviewed  
and is approved.

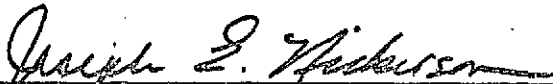
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Photo Science Office

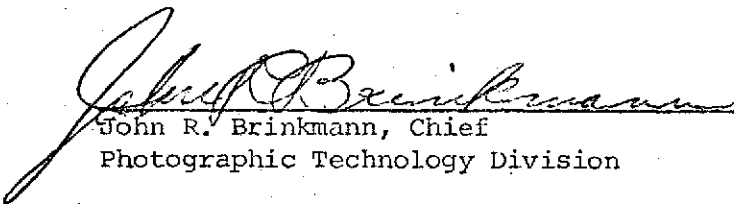
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## THERMAL AND RADIATION DAMAGE TO SL/1 EREP FILMS

Tests were conducted to determine the present sensitometric characteristics of the SL/1 EREP films stored in Skylab. These films underwent the high temperature environment at the beginning of the mission and have since been stored outside the film vault. As a result, the films will have received a radiation dose estimated at approximately 12 rads by the end of SL/3.

### SENSITOMETRY

Samples of the flight emulsions which had experienced the full mission thermal environment in real-time simulation tests were given a postsensitometric exposure on the I-B sensitometer. The film samples were then given a radiation dose of 11.5 rads from a 120 Curie Cobalt<sub>60</sub> source.

### FILM PROCESSING

The processes used for the color and color IR films were essentially the same as flight processing. Changes were made in the processing of the SO-022 film in order to decrease its sensitivity to radiation. The 2424 film was processed in the Versamat processor, giving essentially the same sensitometric characteristics, but with a 1/2 stop increase in speed.

## SENSITOMETRIC EFFECTS

### Film Type 2424

The irradiated film samples and a control strip were processed in the Versamat Processor with MX-641 chemistry. The process gamma was the same as flight processing (1.70), but film speed was 1/2 stop faster.

The resulting sensitometric curve shows an extremely high fog level (1.34), a large loss of Dmax, and a speed loss of about 3 stops. It is doubtful that the film would be usable with these characteristics. Some special processing techniques may be able to improve the characteristics but the imagery will still be only marginally useful.

If the film is used at all, exposures should be increased at least three stops. Further testing is required to determine an exact exposure compensation.

### Film Types 2443/3443

Sensitometric results for these films indicate an extreme loss of Dmax and contrast, a speed loss of about one stop, and a marked change in color balance.

Previous high temperature tests had resulted in a full roll of film having its emulsion adhere to the base. This could possibly cause damage to the camera, as a result of film residue being left on the reseal surface, or due to a strain being put on the drive system by film binding.

ORIGINAL PAGE IS  
OF POOR QUALITY

Film Types SO-356/SO-242

The only significant changes to these films occur in the blue sensitive layer, causing a large loss of Dmax. The red and green sensitive layers show a small loss of Dmax, contrast, and speed. The speed loss, however, is not enough to require exposure compensation.

Film Type SO-022

This film showed almost no change due to heat and only a small increase in fog due to radiation (when processed in the reduced speed AMPS process).

## RECOMMENDATIONS

### Film Type 2424

It is doubtful that this film will be useful. However, the possibility of retrieving some information by special processing does exist. Exposures should be increased 3 1/2 stops.

It is absolutely essential that some portion of this film be reserved for sensitometric testing. At least 10 feet of unexposed film will be needed.

### Film Types 2443/3443

The poor sensitometric response of these films make the information return very marginal. When the possibility of physical damage is taken into account, the risk of camera damage becomes too high to justify the acquisition of such highly degraded data.

It is recommended that the 2443 and 3443 not be used at all.

### Film Types SO-356/SO-242

The red and green sensitive layers of these films will yield good data return, while the highly degraded blue layer will add a very blue cast to the original film.

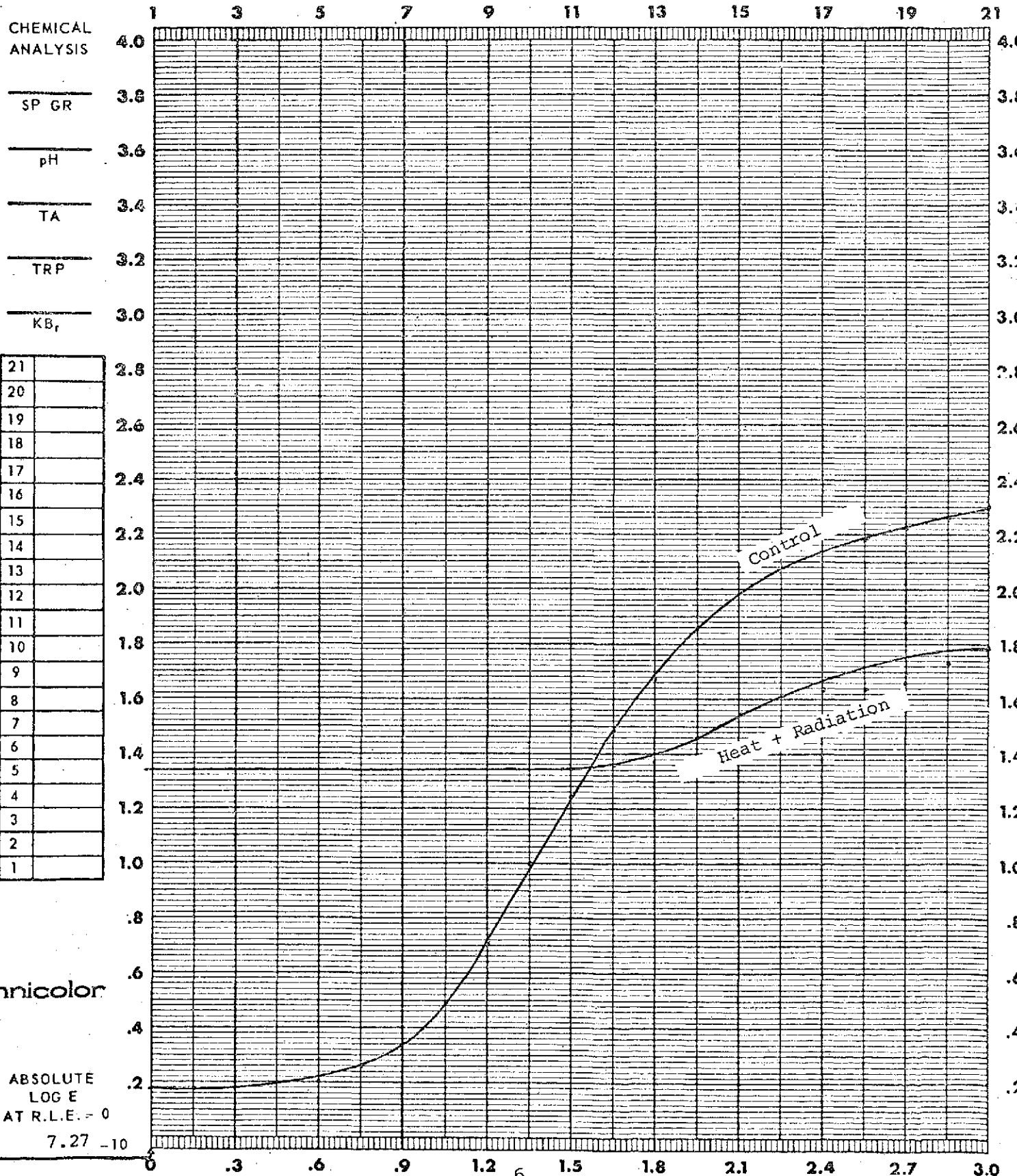
These films should be used with no change in exposure.

Film Type SO-022

This film should give very good data return. The fog density will only serve to increase the average densities and decrease the contrast. These effects can be compensated for in duplication, but will result in some increase in granularity.

Exposures should be increased by 1 stop to compensate for the changes in processing and fog level.

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	<u>I-B</u>	PROCESSOR	<u>Versamat</u>	INSTRUMENT	<u>MacBeth</u>
ILLUMINANT	<u>2850 °K</u>	CHEMISTRY	<u>MX-641</u>	TYPE	<u>TD217DR</u>
TIME	<u>1/50</u> SEC.	SPEED	<u>2</u> TANKS <u>7</u> FPM	APERTURE SIZE	<u>2</u> MM
FILTER	<u>5500 + 89B</u>	TEMP °F	<u>78</u> TIME _____	FILTER	<u>Visual</u>
					SPEED ( ) _____
					D-MAX _____
					GAMMA <u>1.67</u>
					BASE + FOG <u>1.34</u>

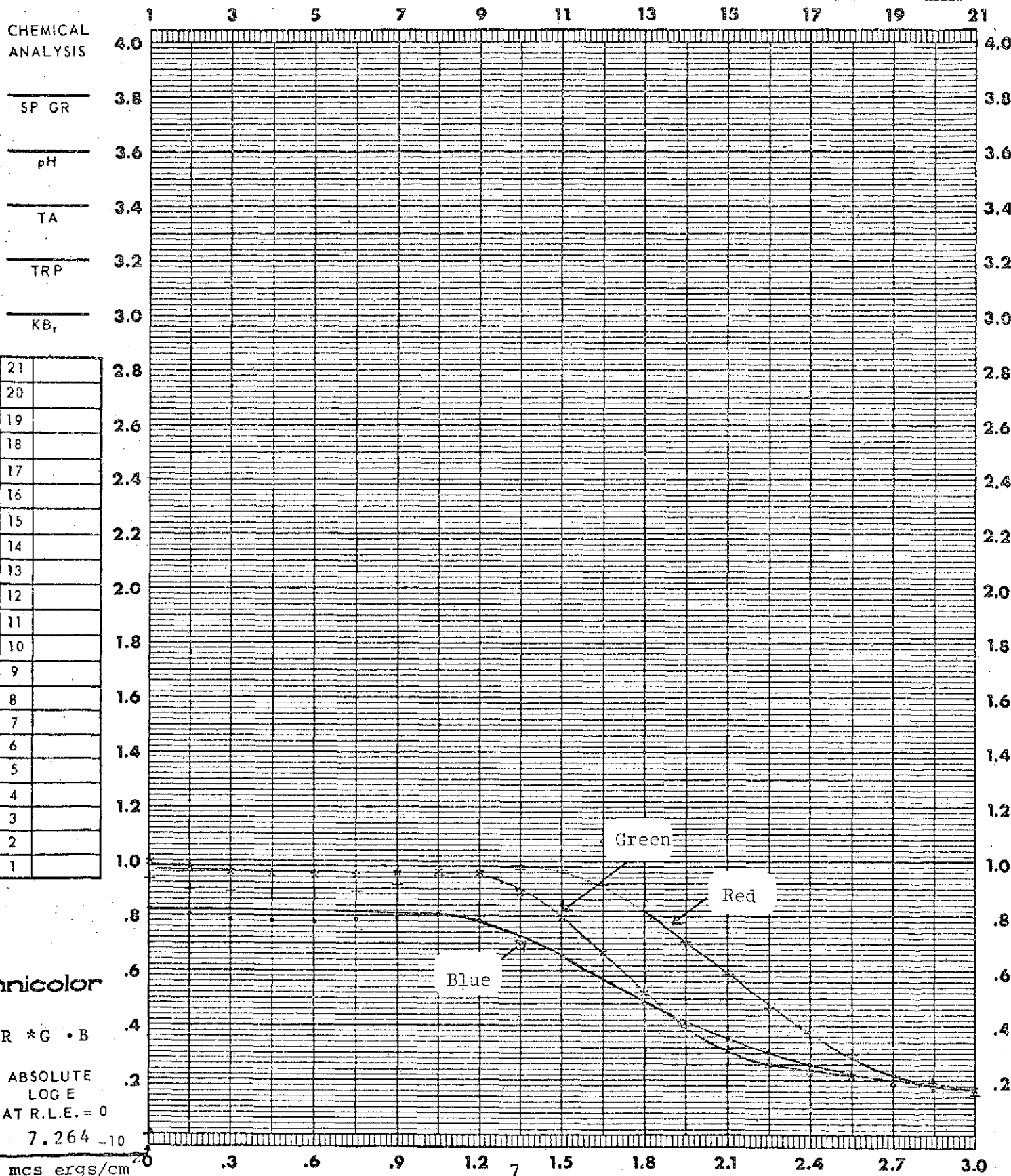




DATE 13 Sep 73 CONTROL # Heat + 11.5 Rads TASK \_\_\_\_\_ PREPARED BY \_\_\_\_\_

FILM 2443 EMULSION # 116-1 MFG \_\_\_\_\_ EXPIRATION DATE \_\_\_\_\_

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	<u>I-B</u>	PROCESSOR	<u>1811 VMT</u>	INSTRUMENT	<u>MacBeth</u>
ILLUMINANT	<u>2850 °K</u>	CHEMISTRY	<u>EA-5</u>	TYPE	<u>TD504</u>
TIME	<u>1/50</u> SEC.	SPEED	<u>TANKS 7</u> FPM	APERTURE SIZE	<u>3</u> MM
FILTER	<u>5500°K + W12</u>	TEMP °F	<u>110</u>	FILTER	<u>RGB</u>
					SPEED (ASA) <u>52</u>
					D-MAX _____
					GAMMA _____
					BASE + FOG _____



DATE 13 Sep 73 CONTROL # Heat + 11.5 Rads TASK                      PREPARED BY                     

FILM 3443 EMULSION # 11-2 MFG                      EXPIRATION DATE                     

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	<u>I-B</u>	PROCESSOR	<u>1811 VMT</u>	INSTRUMENT	<u>MacBeth</u>
ILLUMINANT	<u>2850 °K</u>	CHEMISTRY	<u>EA-5</u>	TYPE	<u>TD504</u>
TIME	<u>1/50</u> SEC.	SPEED	<u>TANKS</u>	APERTURE SIZE	<u>3</u> MM
FILTER	<u>5500°K + W12</u>	TEMP °F	<u>110</u>	FILTER	<u>R G B</u>
		TIME	<u>7</u> FPM		
				SPEED ( ASA )	<u>55</u>
				D-MAX	<u>                    </u>
				GAMMA	<u>                    </u>
				BASE + FOG	<u>                    </u>

CHEMICAL  
ANALYSIS

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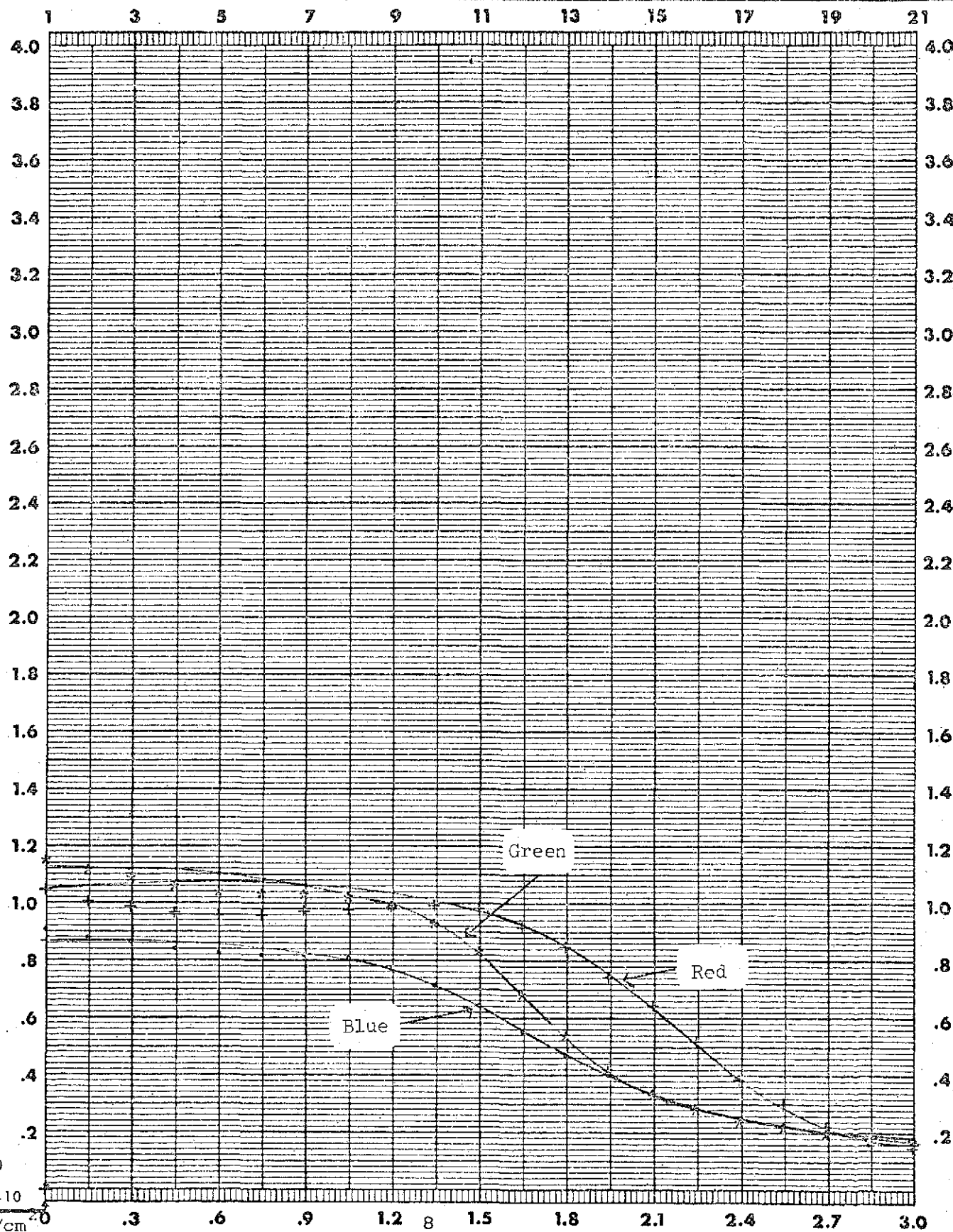
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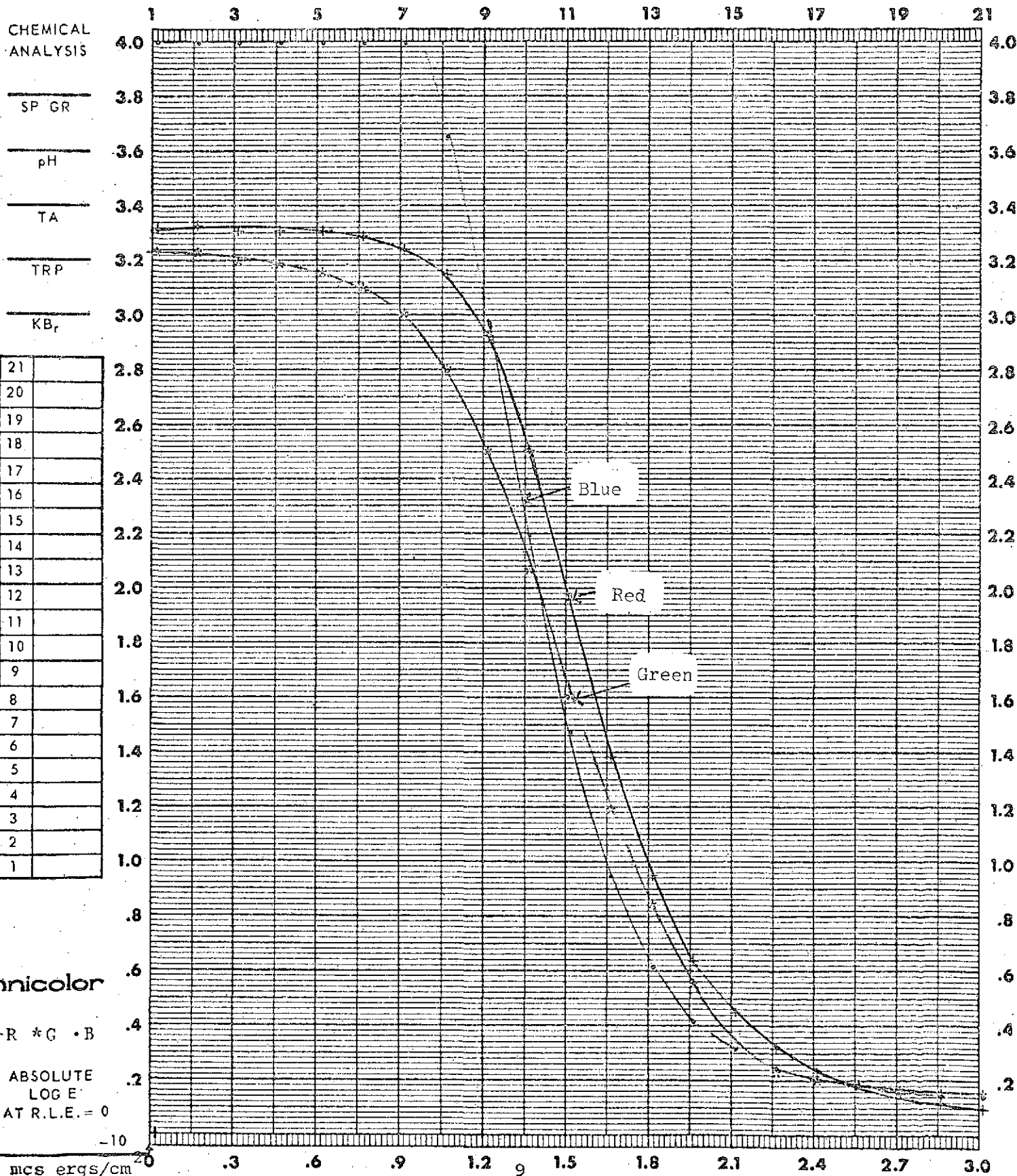
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DATE 13 Sep 73 CONTROL # Control TASK \_\_\_\_\_ PREPARED BY \_\_\_\_\_

FILM 2443 EMULSION # 116-3 MFG \_\_\_\_\_ EXPIRATION DATE \_\_\_\_\_

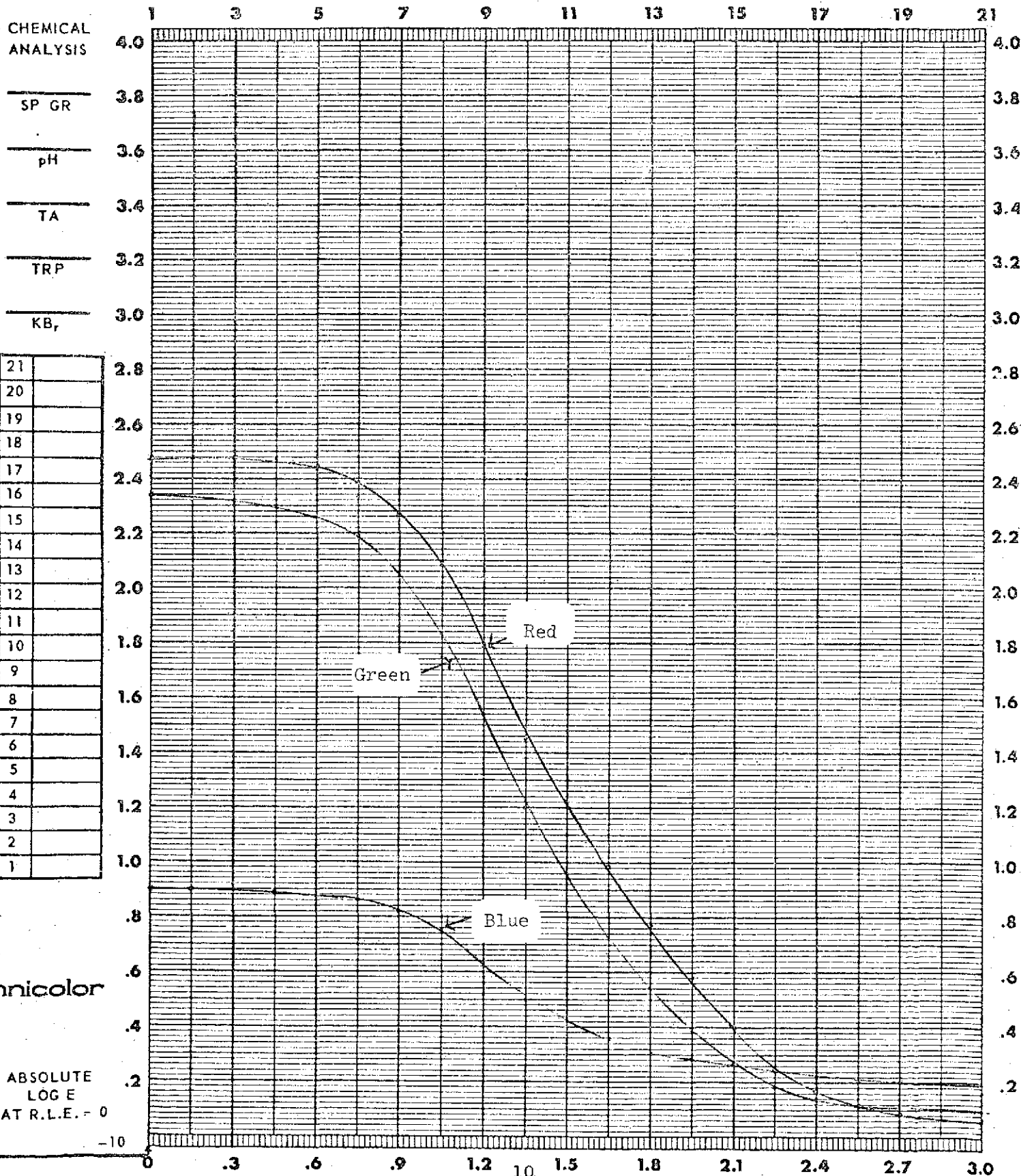
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SENSITOMETER	I-B	PROCESSOR	1811 VMT	INSTRUMENT	MacBeth
ILLUMINANT	2850 °K	CHEMISTRY	EA-5	TYPE	TD504
TIME	1/50 SEC.	SPEED	TANKS 7 FPM	APERTURE SIZE	3 MM
FILTER	5500°K + W12	TEMP °F	110 TIME	FILTER	R B G
					SPEED (ASA) 70
					D-MAX
					GAMMA
					BASE + FOG



DATE 13 Sep 73 CONTROL # Heat + 11.5 Rads TASK \_\_\_\_\_ PREPARED BY \_\_\_\_\_

FILM SO-356 EMULSION # \_\_\_\_\_ 16-4 MFG \_\_\_\_\_ EXPIRATION DATE \_\_\_\_\_

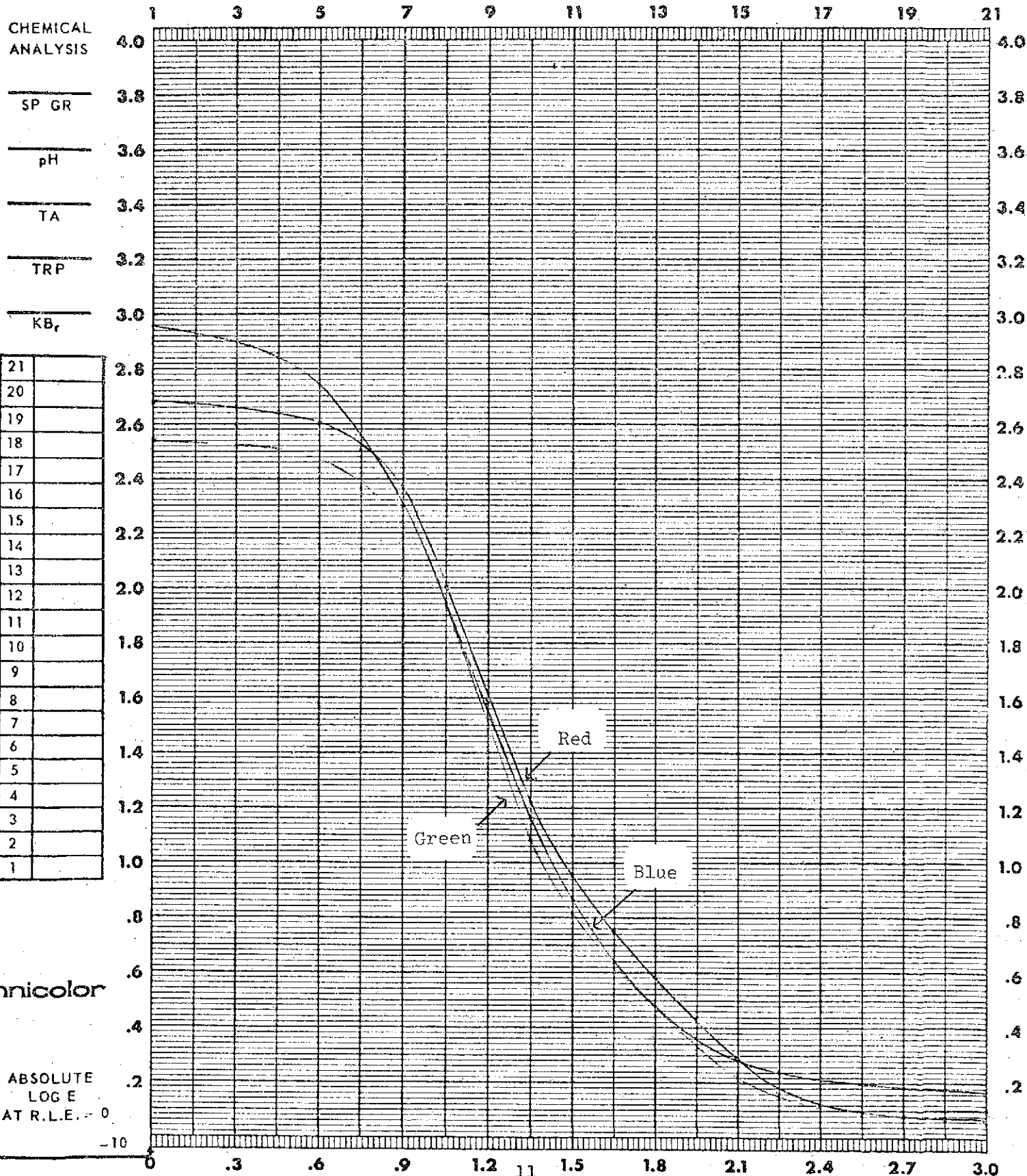
EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	<u>I-B</u>	PROCESSOR	<u>Houston</u>	INSTRUMENT	<u>MacBeth</u>
ILLUMINANT	<u>2850 °K</u>	CHEMISTRY	<u>ME-4</u>	TYPE	<u>TD504</u>
TIME	<u>1/5</u> SEC.	SPEED	<u>TANKS 15 FPM</u>	APERTURE SIZE	<u>3</u> MM
FILTER	<u>5500°K</u>	TEMP °F	<u>98</u>	FILTER	<u>R G B</u>
		TIME			<u>BASE + FOG</u>



DATE 13 Sep 73 CONTROL # Control TASK \_\_\_\_\_ PREPARED BY \_\_\_\_\_

FILM SO-356 EMULSION # 16-4 MFG \_\_\_\_\_ EXPIRATION DATE \_\_\_\_\_

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	<u>I-B</u>	PROCESSOR	<u>Houston</u>	INSTRUMENT	<u>MacBeth</u>
ILLUMINANT	<u>2850 °K</u>	CHEMISTRY	<u>ME-4</u>	TYPE	<u>TD504</u>
TIME	<u>1/5</u> SEC.	SPEED	<u>TANKS 15 FPM</u>	APERTURE SIZE	<u>3</u> MM
FILTER	<u>5500°K</u>	TEMP °F	<u>98</u>	TIME	
				FILTER	<u>R G B</u>
					SPEED ( )
					D-MAX
					GAMMA
					BASE + FOG



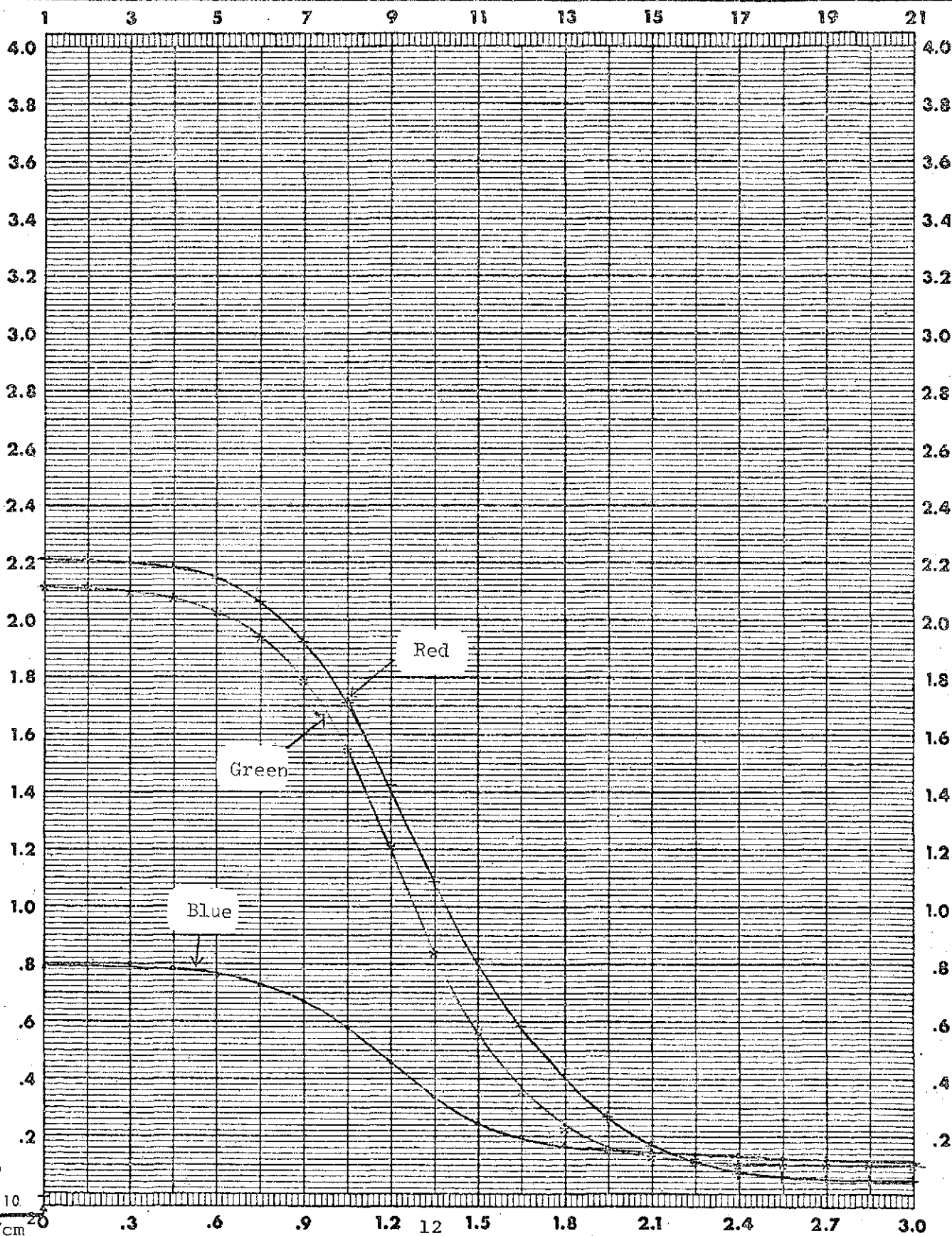
DATE 13 Sep 73 CONTROL # Heat + 11.5 Rads TASK \_\_\_\_\_ PREPARED BY \_\_\_\_\_FILM SO-242 EMULSION # 36 MFG \_\_\_\_\_ EXPIRATION DATE \_\_\_\_\_

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	<u>I-B</u>	PROCESSOR	<u>1811 VMT</u>	INSTRUMENT	<u>MacBeth</u>
ILLUMINANT	<u>2850 °K</u>	CHEMISTRY	<u>EA-5</u>	TYPE	<u>TD504</u>
TIME	<u>1/5</u> SEC.	SPEED	<u>5.5</u> TANKS FPM.	APERTURE SIZE	<u>3</u> MM
FILTER	<u>5500°K</u>	TEMP °F	<u>110</u> TIME	FILTER	<u>R G B</u>
				SPEED ( )	
				D-MAX	
				GAMMA	
				BASE + FOG	

CHEMICAL  
ANALYSIS

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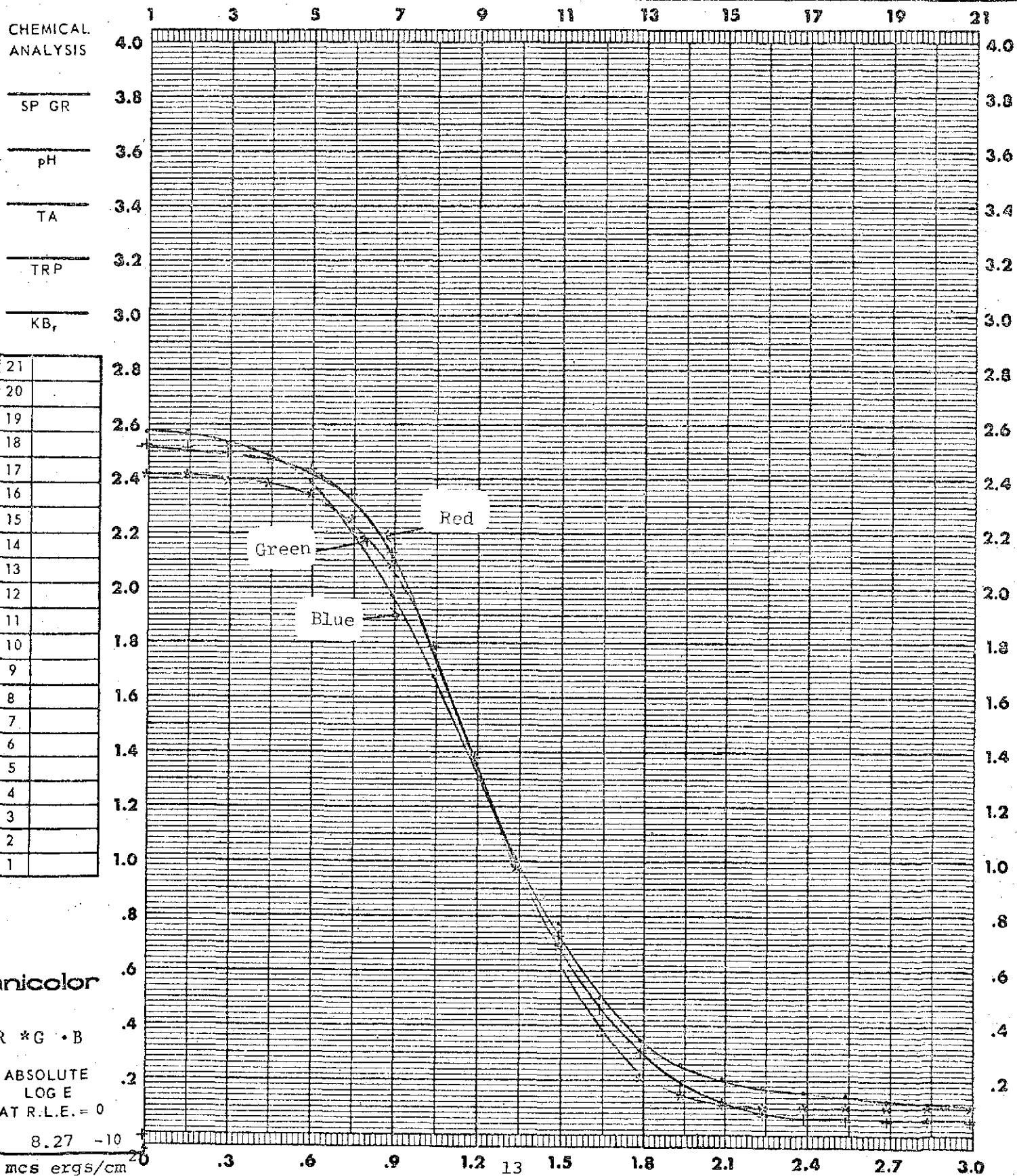




DATE 13 Sep 73 CONTROL # CONTROL TASK                      PREPARED BY                     

FILM SO-242 EMULSION # 36 MFG                      EXPIRATION DATE                     

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	I-B	PROCESSOR	1811 VMT	INSTRUMENT	MacBeth
ILLUMINANT	2850 °K	CHEMISTRY	EA-5	TYPE	TD504
TIME	1/5 SEC.	SPEED	TANKS 5.5 FPM	APERTURE SIZE	3 MM
FILTER	5500°K	TEMP °F	110 TIME	FILTER	R G B
				SPEED (	)
				D-MAX	
				GAMMA	
				BASE + FOG	



DATE 13 Sep 73 CONTROL # Heat + 11.5 Rads TASK \_\_\_\_\_ PREPARED BY \_\_\_\_\_

FILM SO-022 EMULSION # 1-1 MFG \_\_\_\_\_ EXPIRATION DATE \_\_\_\_\_

EXPOSURE DATA		PROCESSING DATA		DENSITOMETRY	
SENSITOMETER	<u>I-B</u>	PROCESSOR	<u>Versamat</u>	INSTRUMENT	<u>MacBeth</u>
ILLUMINANT	<u>2850 °K</u>	CHEMISTRY	<u>MX-641</u>	TYPE	<u>TD217DR</u>
TIME	<u>1/5</u> SEC.	SPEED	<u>1</u> TANKS <u>17</u> FPM	APERTURE SIZE	<u>2</u> MM
FILTER	<u>5500°K + W25</u>	TEMP °F	<u>78.5</u> TIME _____	FILTER	<u>Visual</u>
					<u>BASE + FOG</u>

